* NOTICES *

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the semi-conductor light emitting device which can aim at raise in brightness, and improvement in dependability.
[0002]
[Description of the Prior Art] It is equipped with the AlGaAs semi-conductor base 3, the anode electrode 4, and the cathode electrode 5 which consist of the P type semiconductor region 1 and the N type semiconductor region 2, the conventional semi-conductor light emitting device, i.e., light emitting diode, shown in drawing 1 . On the other hand, the semi-conductor base 3 reached, and PN junction 6 of the interface of the P type semiconductor region 1 and the N type semiconductor region 2 is prolonged in parallel with the principal plane of another side. The anode electrode 4 is arranged at the central part of one principal plane (top face) of the semi-conductor base 3, and is connected to the P type semiconductor region 1. the cathode electrode 5 -- the shape of a grid -- or it is formed so that it may be dotted, and it connects with the principal plane (inferior surface of tongue) 2, i.e., N type semiconductor region, of another side of the semi-conductor base 3. It becomes possible to reflect the cathode electrode 5 in the direction of a top face efficiently in the shape of a grid, and the part in which it emanates from PN junction 6 and the other light is not prepared in the cathode electrode 5 on the inferior surface of tongue if it forms so that it may be dotted. The direction of optical ejection of the semi-conductor light emitting device of drawing 1 is above, and the light emitted to the upper part from PN junction 6 is taken out from the field in which the anode electrode 4 of the top face of the semi-conductor base 3 is not formed. In the semi-conductor light emitting device of drawing 1 , the optical ejection field of the top face of the semi-conductor base 3 is a split face (minute concave convex) 7. This split face 7 decreases the probability of total reflection over the light emitted from PN junction 6, and it is established in order to take out light good outside and to attain high brightness-ization. the time of forming this split face 7 -- the top face of the semi-conductor base 3 -- the anode electrode 4 is mostly formed in the center alternatively, and it etches and split-face-izes on the top face of the semi-conductor base 3 after that.
[0003]
[Problem(s) to be Solved by the Invention] By the way, when the semiconductor device of drawing 1 is formed as mentioned above, the so-called side etching to which this etching advances even in the circumference lower part of the anode electrode 4 in the case of etching for forming a split face 7 may arise. When such side etching arises, there is a possibility that a crack may arise in the semiconductor region 1 of the lower part of an electrode 4 by the stress at the time of carrying out wirebonding on the anode electrode 4 etc. Moreover, when bonding of the wire was carried out to the periphery of the electrode 4 which has produced side etching, since the thrust at the time of bonding was not fully impressed, poor bonding might arise. In addition, it is difficult to discriminate surrounding lower side etching, i.e., the side, or the surrounding lower field by which longitudinal direction etching was carried out of an electrode 4 from the condition of the top face of an electrode 4 in practice, and wirebonding

may have been carried out around the electrode 4.
[0004] Then, it is to offer the semi-conductor light emitting device which can raise dependability while a raise in brightness by split-face-izing is possible for the purpose of this invention.
[0005]
[Means for Solving the Problem] This invention for solving the above-mentioned technical problem and attaining the above-mentioned purpose The semi-conductor base arranged so that the 2nd semiconductor region of the 2nd electric conduction form opposite to the 1st semiconductor region of the 1st electric conduction form and said 1st electric conduction form may form a PN junction, The 1st electrode connected to said 1st semiconductor region in a part of one principal plane of said semi-conductor base, In the semi-conductor light emitting device constituted so that it might have the 2nd electrode connected to said 2nd semiconductor region in the principal plane of another side of said semi-conductor base and light might be taken out to one [said] principal plane side One [said] principal plane is equipped with the mirror plane field and the split-face field, and said mirror plane field is arranged to the field containing the central part of one [said] principal plane. Said split-face field is formed so that the rate of the total reflection of the light which it has been arranged so that said mirror plane field may be surrounded, and carried out incidence to one [said] principal plane from the interior side of said semi-conductor base may be reduced. Said 1st electrode is connected to a part of said mirror plane field and said split-face field. The rim of said 1st electrode is arranged between the rim of said mirror plane field, and the rim of said split-face field, and it is involved in the semi-conductor light emitting device to which a part for the flat part above said mirror plane field of said 1st electrode is characterized by being the connection part of a wire.
[0006]
[Function and Effect of the Invention] In this invention, the periphery of the 1st electrode is arranged on a split-face field, and is close here. Therefore, side etching of the bottom of the periphery of the 1st electrode is hard to be carried out, and the dependability of the connection to the 1st semiconductor region of the 1st electrode improves. Moreover, since the amount of [above the mirror plane field of the 1st electrode] flat part is a connection part, connection of a reliable wire can be attained.
[0007]
[Example] Next, with reference to drawing 2 - drawing 6 , the semi-conductor light emitting device (light emitting diode) concerning an example and its manufacture approach of this invention are explained. The light emitting device of drawing 2 has AlGaAs or the GaAs semi-conductor base 13 which consists of the P type semiconductor region 11 as the 1st semiconductor region, and the N type semiconductor region 12 as the 2nd semiconductor region. the anode electrode 14 as the 1st electrode forms in the center of the top face of top-face (one principal plane) 13a11 of the semi-conductor base 13, i.e., a P type semiconductor region, -- having -- the inferior surface of tongue of inferior-surface-of-tongue (principal plane of another side) 13b12 of the semi-conductor base 13, i.e., an N type semiconductor region, -- the cathode electrode 15 as the 2nd electrode -- the shape of a grid -- or it is formed so that it may be dotted. the cathode electrode 15 -- electroconductive glue -- external wiring -- it connects with a conductor. This electroconductive glue adheres also to the part in which the cathode electrode 15 of the inferior surface of tongue of the semi-conductor base 13 is not formed, and it is contributed in order to reflect the other light upwards downward. Since PN junction 16 between the P type semiconductor region 11 and the N type semiconductor region 12 is formed in parallel to top-face 13a and inferior-surface-of-tongue 13b of the semi-conductor base 13, this edge has been exposed to the side face of a base 13.
[0008] The mirror plane field 17 and the split-face field 18 are formed in the top face of the P type semiconductor region 11 of the light emitting device of drawing 2 . The mirror plane field 17 has an almost circular flat-surface configuration corresponding to the anode electrode 14 of the top face of the P type semiconductor region 11 which it is mostly formed in the center and is shown by the dotted line, as shown in drawing 3 . Moreover, the mirror plane field 17 is arranged inside the anode electrode 14, and the width of face (path) is smaller than the width of face (path) of the anode electrode 14. The split-face field 18 is a minute concave convex for controlling the total reflection of the other light from PN

junction 16 to the upper part, and taking out light good outside, and it is annularly formed so that it may see superficially and the periphery of the mirror plane field 17 may be surrounded.
[0009] The anode electrode 14 is formed in the inside part of the split-face field 18 which sees superficially and adjoins all of the mirror plane fields 17, and this. Therefore, the rim of the mirror plane field 17 is located inside the rim of the anode electrode 14, and the rim of the anode electrode 14 is located between the rim of the mirror plane field 17, and the rim of the split-face field 18, i.e., the rim of a base 13. Since the split-face field 18 is etched and formed in top-face 13a of a base 13 like the after-mentioned, the split-face field 18 is biased to the principal plane 13b side of another side of a base 13 rather than the mirror plane field 17 in the mirror plane field 17, without being located on the same flat surface. Consequently, it is biasing to the principal plane 13b side of another side of a base 13 rather than the part which the part which counters above the split-face field 18 of the anode electrode 14 counters above the mirror plane field 17. Moreover, although the top face of an electrode 14 is a mirror plane in the upper part of the mirror plane field 17, it is split-face-ized in the upper part of the split-face field 18.
[0010] When forming the semi-conductor base 13 shown in drawing 2 and drawing 3 , the semi-conductor wafer 19 which has the P type semiconductor region 11 which can obtain two or more light emitting devices as shown in drawing 4 , and the N type semiconductor region 12 is prepared. Next, after forming the resist film in the whole top face of a wafer 19, it etches alternatively, and the mask 21 which has the opening 20 corresponding to the part which obtains the split-face field 18 of each light emitting device is formed as shown in drawing 4 . In addition, the mask 21 has covered the part used as the mirror plane field 17.
[0011] Next, it etches into the top face of the wafer 19 exposed from the opening 20 of this mask 21, and as shown in drawing 5 , the split-face field 18 is formed. Next, a mask 21 is removed. Since the field covered with the mask 21 is not etched, it is the field 17, i.e., a mirror plane field, where irregularity is smaller than the split-face field 18. Consequently, on the top face of a wafer 19, it is dotted with two or more mirror plane fields 17 in the shape of an island, and this mirror plane field 17 is surrounded by the split-face field 18.
[0012] Next, vacuum deposition of the Au(gold) is carried out to the whole top face of a wafer 19, it etches so that only the part which covers the top face of the mirror plane field 17 of this Au vacuum evaporationo film and the top face of the split-face field 18 near [that] the circumference after an appropriate time may be made to remain, and as shown in drawing 6 , the anode electrode 14 is formed.
[0013] Next, vacuum evaporationo and etching of Au film are performed like the principal plane of another side of a wafer 19, and the cathode electrode 15 which is a rear-face electrode is formed. In addition, this cathode electrode 15 may be formed before formation of the anode electrode 14.
[0014] Next, well-known dicing divides the wafer 19 shown in drawing 6 , and the light emitting device according to individual is obtained. Finally, in order to remove the damage of the base 13 at the time of this dicing, the side face of a base 13 is etched. Under the present circumstances, although side etching may arise under the periphery of the anode electrode 14, since the circumference of the anode electrode 14 has stuck to the split-face field 18, there are few amounts of side etching.
[0015] the cathode electrode 15 of the light emitting device of drawing 2 -- external wiring -- a conductor is soldered, and as a dotted line shows, bonding of the wire 22 is carried out to flat part part 14a of the center of the anode electrode 14.
[0016] According to this example, the following effectiveness is acquired.
(**) The split-face field 18 is served as, the part, i.e., the optical ejection side, of top-face 13a of a base 13 which is not covered with an electrode 14. Therefore, the total reflection of the other light can be controlled from PN junction 16 to the upper part, this light can be taken out good to the exterior of a component, and high brightness-ization is realized as a result.
(**) Since the anode electrode 14 is formed ranging over the mirror plane field 17 and the split-face field 18 and the periphery of an electrode 14 has combined with a part of split-face field 18 closely, even if side etching arises, this can be stopped into the **** circumference part of an electrode 14, and it can prevent that side etching advances even to the mirror plane field 17 side. Therefore, a base 13 and an

electrode 14 stick firmly and the dependability of a light emitting device improves.
(**) Since upper flat part part 14a of the mirror plane field 17 of an electrode 14 and upper split-face partial 14b of the split-face field 18 can be distinguished optically and can carry out pattern recognition, flat part part 14a can be correctly identified with automatic wirebonding equipment, and bonding of the wire 22 can be carried out good, and don't make a semiconductor region 11 generate a crack. In addition, in the conventional light emitting device of drawing 1 , even if the circumference lower part of an electrode 4 was etched, it was impossible to have recognized optically from the top-face side of an electrode 4. Moreover, although split-face-izing the whole top face of a base 3, having split-face-ized on this and forming an electrode 4 was also considered before forming an electrode 4, it was impossible for the whole top face of an electrode 4 to have been in status idem also in this case, and to have recognized the etching field of the circumference lower part of an electrode 4 from the top face of an electrode 4. Thus, when wirebonding is carried out with the normal part of an electrode 4 not recognized, the boundary region (abnormality part by etching) of an electrode 4 is pressed by the capillary of common knowledge of automatic wirebonding equipment, and there is a possibility that a crack may occur in a semiconductor region 1. On the other hand, according to this example, as already explained, poor bonding and a crack can be prevented.
[0017]
[Modification(s)] This invention is not limited to an above-mentioned example, and the next deformation is possible for it.
(1) In order to make good ohmic contact to electrodes 4 and 5, P type with high impurity concentration higher than the P type semiconductor region 11 and the N type semiconductor region 12 and an N type semiconductor region can be established in a top-face and inferior-surface-of-tongue side.
(2) The side face of the semi-conductor base 13 can be made into an inclination side face, i.e., a mesa configuration.
(3) Form an electrode 14 comparatively thickly, it is made for this whole top face to become flat substantially, and split-face partial 14b can be prevented from being generated substantially.

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CLAIMS

[Claim(s)]
[Claim 1] The semi-conductor base arranged so that the 2nd semiconductor region of the 2nd electric conduction form opposite to the 1st semiconductor region of the 1st electric conduction form and said 1st electric conduction form may form a PN junction, The 1st electrode connected to said 1st semiconductor region in a part of one principal plane of said semi-conductor base, In the semi-conductor light emitting device constituted so that it might have the 2nd electrode connected to said 2nd semiconductor region in the principal plane of another side of said semi-conductor base and light might be taken out to one [said] principal plane side One [said] principal plane is equipped with the mirror plane field and the split-face field, and said mirror plane field is arranged to the field containing the central part of one [said] principal plane. Said split-face field is formed so that the rate of the total reflection of the light which it has been arranged so that said mirror plane field may be surrounded, and carried out incidence to one [said] principal plane from the interior side of said semi-conductor base may be reduced. Said 1st electrode is connected to a part of said mirror plane field and said split-face field. The rim of said 1st electrode is a semi-conductor light emitting device characterized by being arranged between the rim of said mirror plane field, and the rim of said split-face field, and the amount of [above said mirror plane field of said 1st electrode] flat part having become the connection part of a wire.

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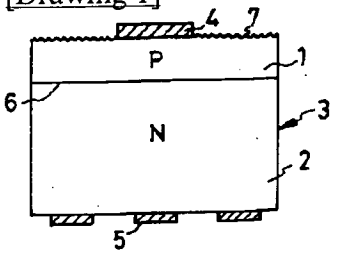
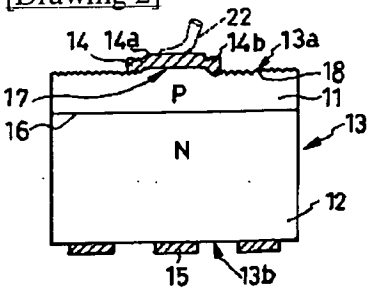
DRAWINGS

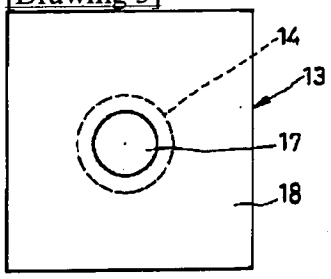
[Drawing 1]



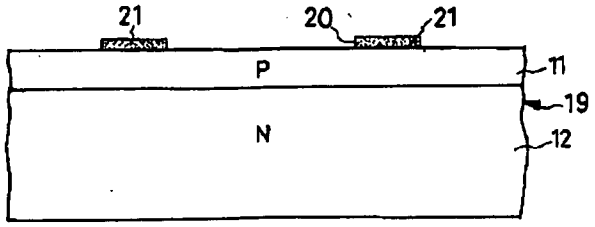
[Drawing 2]



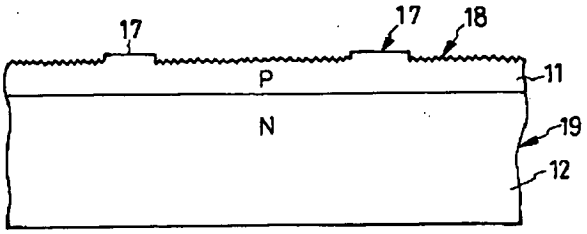
[Drawing 3]



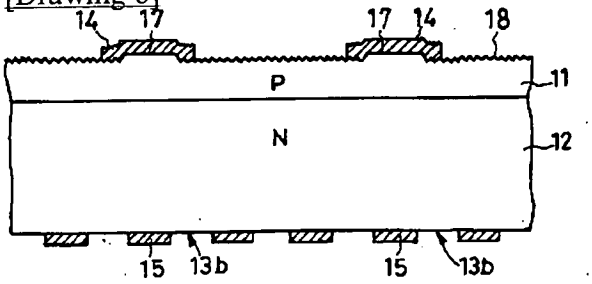
[Drawing 4]



[Drawing 5]



[Drawing 6]



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